

## THE MACROLEPIDOPTERA OF THE ROTHAMSTED ESTATE, HARPENDEN, HERTFORDSHIRE

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### Introduction

ROTHAMSTED EXPERIMENTAL Station (IACR Rothamsted) is situated on a 330 hectare estate in Hertfordshire, south-east England, in the Ordnance Survey 10km square TL11. It was founded in 1843 by John Bennet Lawes primarily to study soil fertility and plant growth. It is well-known for its long-running "classical" experiments but its work now covers a wide range of agricultural research, particularly concerning arable crops.

Lepidoptera were first sampled at Rothamsted in 1933 by C.B. Williams. He found that moths were an ideal group to use in his research into various aspects of insect ecology, including the effects of weather on insects and their community structure (Williams, 1939; 1940). They are common, easy to sample, relatively easy to identify and, as a group, represent a broad range of ecological requirements. His work later resulted in a clearer understanding of how animal populations are structured and led to the development of a quantitative measurement of species diversity based on a parameter, alpha, from the log-series distribution (Fisher, Corbet & Williams, 1943; Taylor, 1984). Moths have been sampled on the Estate more or less continuously since 1933 and Williams' original light-trap site on Barnfield became the first site of the Rothamsted Insect Survey (RIS) national light-trap network. This Network was established in 1960 by L.R. Taylor and the resulting data have been used in over 600 publications on a wide variety of ecological, statistical and taxonomic research (Taylor, 1986). Samples from the standard RIS light-trap designed by C.B. Williams (Williams, 1948) are now used widely to assess the effect of changes in the environment on species diversity, phenology, geographical distribution and for other fundamental ecological research purposes (Woiwod & Harrington, 1994).

As a result of C.B. Williams' studies, the long-term RIS monitoring and related research at Rothamsted, the Estate has become the most intensively and continuously sampled area for moths in the UK and the total species list is comparable in size with that of some entire counties. Several species of national interest have been recorded, including The Brother *Raphia frater*, which remains the only British record (Skinner, 1984), the second British specimen of The Goosefoot Pug *Eupithecia sinuosaria* (Townsend & Riley, 1992b) and the Dusky Peacock *Macaria signaria* (Townsend, 1993c) of which only a few have ever been recorded in Britain. Land use on some parts of the Estate has changed considerably over time and this is reflected in the disappearance of some species and colonisation by others; detailed statistical analyses of these effects using the long-standing sites are in progress. This paper provides a catalogue of the species that have been recorded on the Estate over the last 63 years. It is hoped this inventory will provide an important cornerstone for future work on the Lepidoptera of Hertfordshire.

### A brief description of the Estate

Rothamsted Estate covers approximately 330 hectares and is mainly experimental arable agricultural land. Apart from the peripheral boundaries, there are only a few substantial hedgerows. These are predominantly of Hawthorn *Crataegus* with some Elder *Sambucus nigra*, Blackthorn *Prunus spinosa*, Oak *Quercus robur*, Holly *Ilex aquifolium* and Ash *Fraxinus excelsior*. A few scattered standard trees remain, mainly Oak and Ash, though there are avenues of Limes *Tilia platyphyllos* and *T. x europaea*, Black Poplar *Populus* hybrids and Black Pine *Pinus nigra*. The Poplar avenue is particularly important as a food source for Lepidoptera as there are few other *Populus* species growing in the Harpenden area.

There are three important woodland sites. Knott Wood is now a small (approximately 10 hectares) fragment of a formerly larger ancient wood in which Hazel *Corylus avellana* was coppiced. Most of the wood was felled during the late 1930s and the land turned over to arable production. The trees which predominate now are Oak, Ash, Sycamore *Acer pseudoplatanus*, Beech *Fagus sylvatica* and Hazel. The understorey contains several plants that are indicators of ancient woodland, such as the Yellow Archangel *Lamiastrum galeobdolon*, Dog's Mercury *Mercurialis perennis* and Bluebell *Hyacinthoides non-scriptus*, this last forming extensive carpets. The wood is also notable for the presence of Giant Bellflower *Campanula latifolia* which is uncommon in the area. A small area has recently undergone coppicing in an attempt to improve floral diversity. The second woodland is Manor Wood and this forms part of the ornamental gardens surrounding Rothamsted Manor and was, until the felling in the 1930s, continuous with Knott Wood. It is approximately 7.6 hectares in area and contains many introduced tree species such as Pine, Norway spruce *Picea abies* and other conifers. Native species include Birch *Betula pendula* and Oak. There are extensive plantings of Yew *Taxus baccata*, Rhododendron *Rhododendron* cultivars and Cherry Laurel *Prunus laurocerasus*. The third woodland is Geescroft Wilderness which covers approximately 0.75 hectares. This area was agricultural land until 1882 when it was allowed to revert to woodland by natural succession. The dominant trees here are Oak and Hawthorn with some Field Maple *Acer campestre* and, in some parts, a dense understorey of Holly.

Of the "classical" long-term experimental areas (Fig. 1), the most important entomologically is Park Grass where hay has been grown continuously under controlled fertilizer regimes since 1856 and was unimproved grassland for 100 years before that (Rothamsted Experimental Station, 1991). Apart from harvesting twice a year, this area is relatively undisturbed. The floral diversity is great and provides a haven for those Lepidoptera associated with meadowland habitats. It is a site for the nationally scarce plant, the Snake's Head Fritillary *Fritillaria meleagris*.

Through the western end of the Estate runs a disused railway track which is now a recreational footpath. The diversity of herbaceous plants here is great and includes many garden "escapes". Also present are quantities of Sallow *Salix*, Elm *Ulmus*, Field Maple and Bramble *Rubus fruticosus*.



There is a small pond in the Manor gardens and the River Ver flows through the western edge of the Estate. Unfortunately, little is known of the Lepidoptera of these wet habitats. Until recently the river was often dry but the situation has improved since the reduction of groundwater extraction some three years ago.

## Methods

### Types of traps

Since 1933, the main sampling method for Lepidoptera recording on the Estate has been the standard RIS light-trap although other designs of light- and suction-traps have been used for particular studies. Some of these, such as the standard Robinson-pattern mercury-vapour trap, (Robinson & Robinson, 1950), are familiar to lepidopterists and are commercially available (Waring, 1994). However, others were designed at Rothamsted for specific on-site studies. The following is a list of all trap designs used with a description of the equipment where necessary.

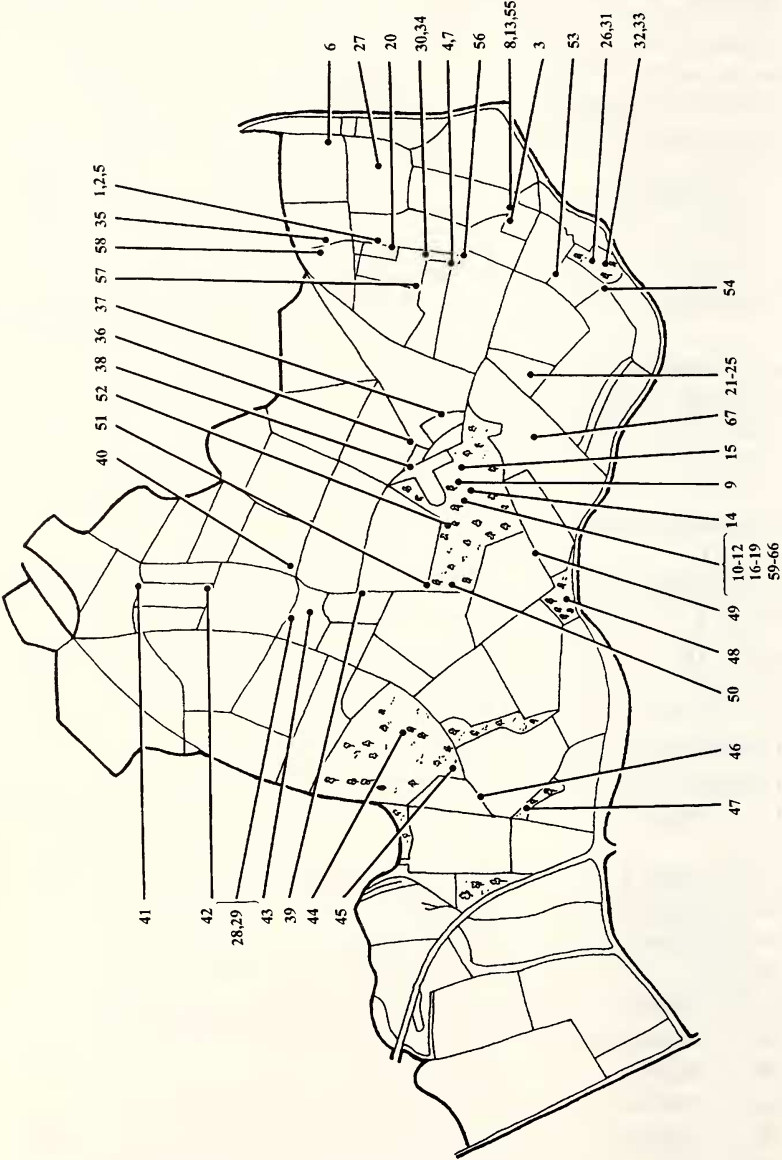
- RIS** The standard (RIS) Rothamsted light-trap as described by Williams (1948). It comprises a mains-supplied 200 watt tungsten lamp at 1.5 m above ground level within a glass trap fixed to a timber base beneath an opaque metal lid. These traps usually operate every night of the year.
- MV** Standard Robinson 125 watt mercury-vapour light-trap known to most lepidopterists.
- ROUND TRAP** Similar to RIS trap, using 200 watt tungsten lamp, but set on a round, rather than square, base.
- RMV** RIS light-trap with 125 watt mercury-vapour lamp.
- MVT** Robinson light-trap with 200 watt tungsten lamp.
- S18** Small suction-trap comprising a fan 46cm from ground level which draws insects through a gauze funnel into a collecting jar at its base.
- S9** As S18 but 22.5cm from ground level.
- S12** Described by Macaulay, Tatchell and Taylor (1988), this is the standard RIS "12 metre" suction-trap used for sampling aphids. It comprises a 3 m-high box containing a powerful fan which draws air down a pipe with the inlet at 12.2 m above ground-level. Insects are drawn into a netting funnel inside the box and into a collecting jar. These usually operate continuously.
- S1.5** Suction-trap similar to S12 but smaller with the inlet at 1.5 m above ground level.
- HST** Suction-trap with 2 m box similar to S12. Laid horizontally with inlet cut into the dorsal surface of the box (no pipe) and set at 1.5 m above ground level.

### Positions of sampling sites with trap type and period of sampling.

Figure 2 shows the positions of all the trapping sites. Their names, the type of trap used, and the period over which they operated, are given below. The numbers on the left are those used to identify each site in the systematic list. The site number given in brackets for some of the traps and the site names in bold text are those used to identify the site on the Rothamsted database. Where the design and purpose of specific experiments are published, a literature reference is given. Site 49 (Park Grass) operates as part of the UK Environmental Change Network (Sykes & Lane, 1996).

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|-----|--------------------|---|
| 1.  | <b>Barnfield</b>   | (Trap A; Site No. 1). RIS trap. 1933-1937; (Williams, 1935; 1936; 1939; 1940); 1946-'50 (Williams, 1948; 1951b; Banergee & French, 1952); 1960 to date. |
| 2.  | <b>Bi</b>          | Round trap. April 1933.   |
| 3.  | <b>Bii</b>         | Round trap. On the roof of a building at an approximate height of 10 m. August & September 1933; August & September 1934.                               |
| 4.  | <b>Biii</b>        | Round trap. September & October 1934.   |
| 5.  | <b>Biv</b>         | Round trap. Suspended approximately 10 m above the Barnfield trap. November & December 1934; May to October 1935; May and June 1936.                    |
| 6.  | <b>B</b>           | (Site No. 6). RIS trap. On a laboratory roof. 1946-'50.   |
| 7.  | <b>C</b>           | (Site No. 7). RIS trap. 1946-1947.  |
| 8.  | <b>D</b>           | (Site No. 8). RIS trap. 1948-1949.  |
| 9.  | <b>E1-6</b>        | A group of six RIS traps. July 1949. (French, 1951).  |
| 10. | <b>T</b>           | RIS trap. August 1950 (Williams, 1951a).  |
| 11. | <b>Tm</b>          | RMV trap. August 1950 (Williams, 1951a).  |
| 12. | <b>R</b>           | MV trap. August 1950 (Williams, 1951a).   |
| 13. | <b>RD</b>          | MV trap. August 1950.   |
| 14. | <b>F</b>           | RMV trap. 1951 (Hosni, 1953).   |
| 15. | <b>G</b>           | RMV trap. 1951 (Hosni, 1953).   |
| 16. | <b>Manor A</b>     | RIS trap. May to September 1953 (Williams, French & Hosni, 1955).   |
| 17. | <b>Manor B</b>     | RMV trap. As Manor A.   |
| 18. | <b>Manor C</b>     | MVT trap. As Manor A.   |
| 19. | <b>Manor D</b>     | MV trap. As Manor A.  |
| 20. | <b>H</b>           | RMV trap. May to October 1956.  |
| 21. | <b>Highfield</b>   | S18 trap in oat crop. June to August 1963.  |
| 22. | <b>Highfield A</b> | S9 trap in oat crop. June to August 1963.   |
| 23. | <b>Highfield C</b> | As Highfield A.   |
| 24. | <b>Highfield D</b> | As Highfield A.   |
| 25. | <b>Highfield E</b> | As Highfield A.   |
| 26. | <b>GI</b>          | (Site No. 22). RIS trap. 1965 to date.  |
| 27. | <b>Allotments</b>  | (Site No. 34). RIS trap. 1966 to date.  |

Figure 2. Positions of sampling sites on the Rothamsted Estate from 1933 to 1996.



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| 28. | <b>Farm I</b>              | (Site No. 902). S12 trap. 1969-1973.                                     |
| 29. | <b>Farm II</b>             | (Site No. 920). S12 trap. 1970-1973.                                     |
| 30. | <b>Tower</b>               | (Site No. 901). S12 trap. 1970 to date.                                  |
| 31. | <b>GI Suction</b>          | (Site No. 504). HST trap. June 1972 to September 1973.                   |
| 32. | <b>GII Suction</b>         | (Site No. 505). As GI Suction.   |
| 33. | <b>GII</b>                 | (Site No. 99). RIS trap. 1972 to date.                                   |
| 34. | <b>Five Foot</b>           | (Site No. 951). S1.5 trap. 1975 to date.                                 |
| 35. | <b>MVI</b>                 | MV trap. 1981-1982; 1989-1992 and June 1996.                             |
| 36. | <b>MVII</b>                | MV trap. 1989.   |
| 37. | <b>Parklands</b>           | (Site No. 601). RIS trap. 1990 to date (Woiwod, Riley & Townsend, 1990). |
| 38. | <b>Stackyard</b>           | (Site No. 602). As Parklands.  |
| 39. | <b>Little Knott</b>        | (Site No. 603). As Parklands.  |
| 40. | <b>Broadbalk</b>           | (Site No. 604). As Parklands.  |
| 41. | <b>Sawyers</b>             | (Site No. 605). As Parklands.  |
| 42. | <b>Long Hoos</b>           | (Site No. 606). As Parklands.  |
| 43. | <b>Farm</b>                | (Site No. 607). As Parklands.  |
| 44. | <b>Knott Wood I</b>        | (Site No. 608). As Parklands.  |
| 45. | <b>Knott Wood II</b>       | (Site No. 609). As Parklands.  |
| 46. | <b>White Horse</b>         | (Site No. 610). As Parklands.  |
| 47. | <b>White Horse Spinney</b> | (Site No. 611). As Parklands.  |
| 48. | <b>Apiary</b>              | (Site No. 612). As Parklands.  |
| 49. | <b>Park Grass</b>          | (Site No. 613). As Parklands.  |
| 50. | <b>Manor Wood I</b>        | (Site No. 614). As Parklands.  |
| 51. | <b>Pastures</b>            | (Site No. 615). As Parklands.  |
| 52. | <b>Manor Wood II</b>       | (Site No. 616). As Parklands.  |
| 53. | <b>Geescroft Field</b>     | (Site No. 617). As Parklands.  |
| 54. | <b>Roadpiece</b>           | (Site No. 618). As Parklands.  |
| 55. | <b>Lodge</b>               | (Site No. 619). As Parklands.  |
| 56. | <b>Great Field</b>         | (Site No. 620). As Parklands.  |
| 57. | <b>Garden Plots</b>        | (Site No. 621). As Parklands.  |
| 58. | <b>Ninnings</b>            | (Site No. 622). As Parklands.  |
| 59. | <b>Manor Wood i</b>        | (Site No. 506). RIS trap. May 1974 to May 1975.                          |
| 60. | <b>Manor Wood ii</b>       | (Site No. 507). As Manor Wood i.   |
| 61. | <b>Manor Wood iii</b>      | (Site No. 508). As Manor Wood i.   |
| 62. | <b>Manor Wood iv</b>       | (Site No. 509). As Manor Wood i.   |
| 63. | <b>Manor Rota</b>          | RIS trap. May to August 1964. (Taylor & French, 1974).                   |
| 64. | <b>Manor Rotb</b>          | As Manor Rota.   |
| 65. | <b>Manor Roba</b>          | MV trap. Otherwise as Manor Rota.  |
| 66. | <b>Manor Robb</b>          | As Manor Roba.   |
| 67. | <b>Highfield T</b>         | A group of nine RIS traps. April to September 1967.                      |

### Identifications

All macrolepidoptera have been identified by staff at Rothamsted. The majority of the species in the genus *Eupithecia* were not identified routinely until 1985. Since 1960, those groups that cannot be identified by wing markings (some *Oligia*, *Epirrita*, *Eupithecia* and *Acronicta* species) were determined by examination of the genitalia. Since 1960, samples from sites 1, 26, 27, 33 and 37-58 have been kept for further examination. This has enabled checking where earlier identifications were considered doubtful. Prior to this and for other sites, it has been difficult to confirm records of unusual species. However, Williams compiled a reference collection during the 1930s and 1940s which contains many confirmatory specimens of species no longer found on the Estate.

### Results

The following catalogue represents all the species of macrolepidoptera recorded at Rothamsted between 1933 and 1996. Lepidoptera have been sampled continuously on the Estate apart from the periods 1938-1945 and 1951-1959, Lepidoptera were sampled continuously. For completeness, those diurnal species which have been observed on the Estate, but not recorded in any of the traps, are included.

The nomenclature follows that of Bradley (1998).

### Systematic list

#### HEPIALIDAE

*Hepialus humuli* (L.) Ghost Moth. – Regular and common.

*H. sylvina* (L.) Orange Swift. – Regular and common.

*H. hecta* (L.) Gold Swift. – Recorded only in Geescroft: single records in 1984, '86, '88 & '89.

*H. lupulinus* (L.) Common Swift. – Regular and common.

*H. fusconebulosa* (DeG.) Map-winged Swift. – Regular and common.

#### COSSIDAE

*Zeuzera pyrina* (L.) Leopard Moth. – A few since 1935. Greatest total six in trap 26 in 1952.

Last in 1982 in trap 35.

#### ZYGAENIDAE

*Zygaena filipendulae* (L.) Six-spot Burnet. – Not caught in traps. Frequent on disused railway track.

*Z. lonicerae* (Scher.) Narrow-bordered Five-spot Burnet. – Trap 29, one in 1973. Frequent on disused railway track.

#### SESIIDAE

*Sesia bembeciformis* (Hb.) Lunar Hornet Moth. – Not caught in traps. One female on disused railway track, 1.viii.1980.

#### LASIOCAMPIDAE

*Poecilocampa populi* (L.) December Moth. – Regular and common.

*Trichiura crataegi* (L.) Pale Eggar. – Scattered individuals since 1946.

*Malacosoma neustria* (L.) The Lackey. – Common in the 1930s and 1940s. Not recorded since 1949.

*Lasiocampa quercus* (L.) Oak Eggar. – One in 1948 in trap 9. Scattered individuals since 1983.



*Euthrix potatoria* (L.) The Drinker. – Regular and common.

*Gastropacha quercifolia* (L.) The Lappet. – Regular until 1949, since when only one in trap 35, 18.vi.1990.

#### SATURNIIDAE

*Saturnia pavonia* (L.) Emperor Moth. – Trap 1, one in 1949; trap 37, one in 1992 and trap 51, one in 1992.

#### DREPANIDAE

*Falcaria lacertinaria* (L.) Scalloped Hook-tip. – Only eight individuals. First 1947, last 1982.

*Watsonalla binaria* (Hufn.) Oak Hook-tip. – Frequent at the woodland sites.

*W. cultraria* (Fabr.) Barred Hook-tip. – One in trap 14 in 1951. No others until 1990, several since (Riley & Townsend, 1991c).

*Drepana falcataria* (L.) Pebble Hook-tip. – Four in trap 6, 1946-1948; two in trap 7, 1946; one in trap 1, 1960; one in trap 26 in 1976.

*Cilix glaucata* (Scop.) Chinese Character. – Regular and common.

#### THYATIRIDAE

*Thyatira batis* (L.) Peach Blossom. – Frequent, mainly at woodland sites.

*Habrosyne pyritoides* (Hufn.) Buff Arches. – Most common at woodland sites.

*Tethea ocularis* (L.) Figure of Eighty. – Infrequent but widespread.

*T.* or ([D.&S.]) Poplar Lutestring. – One in trap 1, 4.v.1995.

*Ochropacha duplaris* (L.) Common Lutestring. – First in 1974 in trap 59, mainly Geescroft since.

*Cymatophorima diluta* ([D.&S.]) Oak Lutestring. – Trap 1, one on 26.viii.1933.

*Achlya flavicornis* (L.) Yellow-horned. – Trap 59, one on 9.iii.1993.

*Polyplocia ridens* (Fabr.) Frosted Green. – Three in traps 6 and 8 in 1948; individuals since 1965 only in Geescroft and Manor Wood.

#### GEOMETRIDAE

*Alsophila aescularia* ([D.&S.]) March Moth. – Regular and common.

*Pseudoterpna pruinata* (Hufn.) Grass Emerald. – Frequent in trap 1 to 1949; a few in traps 26, 33 and 27 from 1967 to 1983 but not recorded since.

*Geometra papilionaria* (L.) Large Emerald. – Frequent in traps 1, 6, 7 and 8 during the 1930s and 1940s. Now mainly Geescroft; infrequent.

*Comibaena bajularia* ([D.&S.]) Blotched Emerald. – Frequent in 1930s and 1940s. Not recorded since 1969.

*Hemithea aestivaria* (Hb.) Common Emerald. – Common at woodland sites.

*Chlorissa viridata* (L.) Small Grass Emerald. – Trap 1, one on 14.vii.1948; trap 33, one on 13.viii.1976.

*Hemistola chrysoprasaria* (Esp.) Small Emerald. – Scattered individuals 1947 to 1986.

*Jodis lactearia* (L.) Little Emerald. – Frequent at woodland sites.

*Cyclophora albipunctata* (Hufn.) Birch Mocha. – Trap 6, one in 1948; trap 33 one in 1973 and one in 1974.

*C. punctaria* (L.) Maiden's Blush. – Infrequent, mainly in Geescroft.

*C. linearia* (Hb.) Clay Triple-lines. – Trap 1, one in 1947; trap 9, one in 1949; trap 27, one in 1983.

*Timandra comae* (Schmidt) Blood-vein. – Regular and common.

*Scopula imitaria* (Hb.) Small Blood-vein. – Most common at woodland sites.

*S. floslactata* (Haw.) Cream Wave. – Scattered individuals since 1976; mainly woodlands.

*Idaea ochrata* (Scop.) Bright Wave. – Trap 27, one on 19.vii.1983.

- I. rusticata* (D.&S.) Least Carpet. – First in trap 26 in 1976; recorded frequently since 1994.
- I. biselata* (Hufn.) Small Fan-footed Wave. – Particularly common at woodland sites.
- I. fuscovenosa* (Goeze) Dwarf Cream Wave. – Infrequent, mainly in Geescroft.
- I. seriata* (Schr.) Small Dusty Wave. – Most common at woodland sites.
- I. dimidiata* (Hufn.) Single-dotted Wave. – Most common at woodland sites.
- I. subsericeata* (Haw.) Satin Wave. – Infrequent; traps 1, 24 and 53.
- I. trigeminata* (Haw.) Treble Brown Spot. – Mainly woodland sites. Possibly increasing.
- I. emarginata* (L.) Small Scallop. – Mainly woodland sites. Frequent.
- I. aversata* (L.) Riband Wave. – Regular and common.
- I. straminata* (Borkh.) Plain Wave. – Trap 40, one on 18.vii.1990 (Riley & Townsend, 1991a).
- Rhodometra sacraria* (L.) The Vestal. – Two in 1947; scattered individuals since 1961.
- Orthonama vittata* (Borkh.) Oblique Carpet. – Trap 1, one in 1947; trap 6, one in 1948.
- O. obstipata* (Fabr.) The Gem. – Scattered individuals, most (11) in 1969.
- Xanthorhoe designata* (Hufn.) Flame Carpet. – Frequent, mainly at woodland sites.
- X. spadicearia* ([D.&S.]) Red Twin-spot Carpet. – Frequent, especially in woodlands.
- X. ferrugata* (Cl.) Large Twin-spot Carpet. – Frequent, especially in woodlands.
- X. quadrifasiata* (Cl.) Large Twin-spot Carpet. – Most common in woodlands.
- X. montanata* ([D.&S.]) Silver-ground Carpet. – Most common in woodlands. Widespread.
- X. fluctuata* (L.) Garden Carpet. – Regular and common.
- Scotopteryx bipunctaria* ([D.&S.]) Chalk Carpet. – Trap 6, one in 1948.
- S. chenopodiata* (L.) Shaded Broad-bar. – Frequent but more common in 1940s.
- S. mucronata* (Scop.) Lead Belle. – Frequent in 1940s; declining. Last recorded in 1973.
- S. luridata* (Hufn.) July Belle. – Frequent in 1930s & 1940s; declining. Last recorded in 1981.
- Catarhoe cuculata* (Hufn.) Royal Mantle. – Trap 65, one in 1964.
- C. rubidata* ([D.&S.]) Ruddy Carpet. – Trap 6, one in 1948, two in 1949; trap 14, one in 1951 (Hosni, 1953). (No confirmatory specimens).
- Epirrhoe alternata* (Müll.) Common Carpet. – Regular and common.
- E. rivata* (Hb.) Wood Carpet. – Trap 1, one in 1948 and 1949; trap 6, two in 1948; trap 9, one in 1949; trap 60, one in 1974.
- Campptogramma bilineata* (L.) Yellow Shell. – Widespread and frequent.
- Larentia clavaria* (Haw.) The Mallow. – Frequent in 1930s and 1940s; mainly singletons since; last 1980.
- Anticlea badiata* ([D.&S.]) Shoulder Stripe. – Fluctuates greatly. Most common in woodlands. Definite decline at trap 1 since the 1950's.
- A. derivata* ([D.&S.]) The Streamer. – Fluctuates greatly. Most common at woodlands.
- Mesoleuca albicillata* (L.) Beautiful Carpet. – Infrequent; only at woodlands.
- Pelurga comitata* (L.) Dark Spinach. – Infrequent; mainly woodlands; declined at trap 1 since the 1940s.
- Lampropteryx suffumata* ([D.&S.]) Water Carpet. – Scattered individuals since 1973.
- Cosmorhoe ocellata* (L.) Purple Bar. – Frequent, mainly at woodland sites.
- Eulithis prunata* (L.) The Phoenix. – Frequent, most common in Geescroft.
- E. testata* (L.) The Chevron. – Fluctuating; generally infrequent.
- E. mellinata* (Fabr.) The Spinach. – Widespread; a few individuals most years.
- E. pyraliata* ([D.&S.]) Barred Straw. – Common, particularly in Geescroft.
- Ecliptopera silaceata* ([D.&S.]) Small Phoenix. – Frequent and widespread.
- Chloroclysta miata* (L.) Autumn Green Carpet. – Three in the 1930s in trap 1; trap 8, one in 1949; trap 26, one in 1967.
- C. citrata* (L.) Dark Marbled Carpet. – Infrequent and declining.

- C. truncata* (Hufn.) Common Marbled Carpet. – Widespread and common.
- Cidaria fulvata* (Forst.) Barred Yellow. – Widespread and frequent
- Plemyria rubiginata* ([D.&S.]) Blue-bordered Carpet. – Infrequent; mainly at woodland sites.
- Thera obeliscata* (Hb.) Grey Pine Carpet. – Occasional individuals in several traps but most frequent in Geescroft and Manor Wood.
- T. britannica* (Turn.) Spruce Carpet. – Widespread but infrequent.; possibly increasing.
- T. juniperata* (L.) Juniper Carpet. – First recorded in 1975. Numbers appear to be increasing.
- Electrophaes corylata* (Thunb.) Broken-barred Carpet. – Individuals most years in Geescroft. Infrequent elsewhere.
- Colostygia olivata* ([D.&S.]) Beech-green Carpet. – Trap 1, two in 1935.
- C. multistrigaria* (Haw.) Mottled Grey. – Formerly frequent in trap 1. Not recorded since 1935. Confirmatory specimens are in the RIS collection.
- C. pectinataria* (Knoch) Green Carpet. – Most frequent at woodland sites; occasional elsewhere.
- Hydriomena furcata* (Thunb.) July Highflyer. – Frequent and widespread; mainly at woodland sites.
- H. impluviata* ([D.&S.]) May Highflyer. – Trap 26, one on 2.vi.1982; trap 1, one on 30.vi.1985.
- Horisme vitalbata* ([D.&S.]) Small Waved Umber. – Uncommon. Scattered individuals from 1947 to 1989.
- H. tersata* ([D.&S.]) The Fern. – Infrequent. Most regularly caught in Geescroft.
- Melanthia procellata* ([D.&S.]) Pretty Chalk Carpet. – Regular in Geescroft but fluctuating. Infrequent elsewhere.
- Rheumaptera cervinalis* (Scop.) Scarce Tissue. – Regular in Geescroft. Infrequent elsewhere.
- Triphosia dubitata* (L.) The Tissue. – Usually scattered individuals. Most frequent in Geescroft.
- Philereme vetulata* ([D.&S.]) Brown Scallop. – Geescroft, seven between 1970 and 1982; trap 1, one in 1983.
- P. transversata* (Hufn.) Dark Umber. – Most frequent in Geescroft. First recorded in 1970 in trap 27.
- Euphyia unangulata* (Haw.) Sharp-angled Carpet. – Frequent at woodland sites; scattered individuals elsewhere.
- Epirrita dilutata* ([D.&S.]) November Moth. – Very common at woodland sites.
- E. christyi* (Allen) Pale November Moth. – Common in Manor Wood and Knott Wood. Infrequent elsewhere.
- E. autumnata* (Borkh.) Autumnal Moth. – Trap 60, one in 1974; trap 62, one in 1974; trap 1, one in 1978; trap 51, one in 1991.
- Operophtera brumata* (L.) Winter Moth. – Common, especially at woodland sites.
- O. fagata* (Scharf.) Northern Winter Moth. – Infrequent in Geescroft; trap 1 to 1949.
- Perizoma affinitata* (Steph.) The Rivulet. – First recorded in 1969; subsequently infrequent in Geescroft and trap 1.
- P. alchemillata* (L.) Small Rivulet. – Common in most traps.
- P. bifaciata* (Haw.) Barred Rivulet. – Uncommon. Scattered individuals in traps 1, 37 and in Manor Wood.
- P. albulata* ([D.&S.]) Grass Rivulet. – Trap 26, one in 1966; trap 1, one in 1986.
- P. flavofasciata* (Thunb.) Sandy Carpet. – Frequent at woodland sites; scattered individuals elsewhere.
- P. didymata* (L.) Twin-spot Carpet. – Frequent at woodland sites; individuals elsewhere; formerly frequent in trap 1.

- Eupithecia tenuiata* (Hb.) Slender Pug. – Infrequent; mainly at woodland sites.
- E. inturbata* (Hb.) Maple Pug. – Fairly common in Geescroft; scattered individuals elsewhere, particularly Knott Wood.
- E. haworthiata* Doubl. Haworth's Pug. – Widespread but infrequent.
- E. linariata* ([D.&S.]) Toadflax Pug. – Widespread but infrequent.
- E. pulchellata* Steph. Foxglove Pug. – Most frequent in Geescroft. Irregular elsewhere.
- E. exigua* (Hb.) Mottled Pug. – Common at woodland and hedgerow sites.
- E. pygmaea* (Hb.) Marsh Pug. – Only at trap 49; occasional individuals since 1992.
- E. venosata* (Fabr.) Netted Pug. – Widespread but uncommon. Most frequent in Geescroft.
- E. centaureata* ([D.&S.]) Lime-speck Pug. – Widespread and frequent.
- E. intricata* (Zett.) Freyer's Pug. – Most common in Geescroft and trap 1; infrequent elsewhere.
- E. satyrata* (Hb.) Satyr Pug. – Occasional individuals in traps 1, 26, 48 and 52.
- E. absinthiata* (Cl.) Wormwood Pug. – Widespread and frequent.
- E. assimilata* Doubl. Currant Pug. – Widespread and frequent.
- E. vulgata* (Haw.) Common Pug. – Widespread and common.
- E. tripunctaria* H.-S. White-spotted Pug. – Most frequent at woodland sites.
- E. subfuscata* (Haw.) Grey Pug. – Widespread and common.
- E. icterata* (Vill.) Tawny Speckled Pug. – Widespread and frequent. Most common at woodland sites.
- E. succenturiata* (L.) Bordered Pug. – Widespread and frequent, especially woodland sites.
- E. subumbrata* ([D.&S.]) Shaded Pug. Trap 1, four between 1966 and 1987; trap 49, one in 1990; trap 51, one in 1991.
- E. simpliciatia* (Haw.) Plain Pug. – Widespread but infrequent.
- E. sinuosaria* Evers. Goosefoot Pug. – Trap 45, one in 19-21.vi.1992. Second record for the British Isles (Townsend & Riley, 1992b). Confirmatory specimen in RIS collection.
- E. indigita* (Hb.) Ochreous Pug. – Occasional individuals in traps 1, 26, 33 and 50.
- E. pimpinellata* (Hb.) Pimpinel Pug. – Trap 40, one in 1990; trap 37, one in 1994.
- E. nanata* (Hb.) Narrow-winged Pug. – Individuals some years in Geescroft; trap 27, one in 1979; trap 1, one in 1983.
- E. fraxinata* Crewe Ash Pug. – Trap 33, one on 14.vii.1979 and one on 5.vii.1989; trap 1, one on, 26.vii.1982.
- E. abbreviata* Steph. Brindled Pug. – Common at woodland sites.
- E. dodoneata* Guen. Oak-tree Pug. – First recorded in 1986; subsequently increased in numbers and expanded in range, both on the Estate and nationally (Riley, 1991).
- E. pusillata* ([D.&S.]) Juniper Pug. – Regular in Geescroft, possibly from cultivated *Juniperus* in nearby gardens.
- E. lariciata* (Freyer) Larch Pug. – Occasional in Geescroft; trap 1, one in 1986; trap 9, five in 1949.
- E. tantillaria* (Boisd.) Dwarf Pug. – Occasional in, or near, Manor Wood.
- Chloroclystis v-ata* (Haw.) V-Pug. – Widespread but infrequent.
- C. chloerata* (Mab.) Sloe Pug. – Widespread but uncommon.
- C. rectangulata* (L.) Green Pug. – Frequent, mainly at woodland sites.
- Gymnoscelis ruffasciata* (Haw.) Double-striped Pug. – Frequent at woodland sites; occasional elsewhere.
- Chesias legatella* ([D.&S.]) The Streak. – Uncommon. Evidently frequent in 1930s and 1940s. Irregular since.
- Aplocera plagiata* (L.) Treble-bar. – Regular in 1930s and 1940s; scarce to 1978; not recorded since.

- Euchoeca nebulata* (Scop.) Dingy Shell. – Trap 26; one on 1.vi.1968 and one on 29.vii.1986.
- Asthena albulata* (Hufn.) Small White Wave. – Widespread but infrequent.
- Hydrelia flammeolaria* (Hufn.) Small Yellow Wave. – Regular in woodlands; occasional elsewhere.
- Lobophora halterata* (Hufn.) The Seraphim. – Infrequent; woodlands only.
- Pterapherapteryx sexalata* (Retz.) Small Seraphim. – Trap 1, one in 1946; trap 27, one in 1976.
- Acasis viretata* (Hb.) Yellow-barred Brindle. – Regular in woodlands; occasional elsewhere.
- Abraxas grossulariata* (L.) The Magpie. – Common in Geescroft; regular elsewhere.
- A. sylvata* (Scop.) Clouded Magpie. – Trap 6, one in 1947; trap 9, one in 1949; trap 26, one in 1970.
- Lomaspilis marginata* (L.) Clouded Border. – Regular in Geescroft; scattered individuals elsewhere. Declined since 1940's.
- Ligdia adustata* ([D.&S.]) Scorched Carpet. – Regular but fluctuating in woodland; infrequent elsewhere.
- Macaria notata* (L.) Peacock Moth. – Trap 26, individuals in 1970, 1976 and 1992.
- M. signaria* (Hb.) Dusky Peacock. – One in trap 45 on 2.vii.1992 (Townsend, 1993c).
- M. liturata* (Cl.) Tawny-barred Angle. – Occasional widespread individuals.
- M. wauaria* (L.) V-Moth. – Regular in Geescroft; occasional elsewhere.
- Chiasmia clathrata* (L.) Latticed Heath. – Common in 1930s and 1940s; declining to 1980; not recorded since.
- Petrophora chlorosata* (Scop.) Brown Silver-line. – Occasional individuals; evidently declined in trap 1.
- Plagodis dolabraria* (L.) Scorched Wing. – Regular in woodlands; occasional elsewhere.
- Opisthographis luteolata* (L.) Brimstone Moth. – Common in woodlands; widespread and frequent elsewhere.
- Epione repandaria* (Hufn.) Bordered Beauty. – Three in Geescroft in 1969, 1971 and 1975; trap 9, one in 1949.
- Apeira syringaria* (L.) Lilac Beauty. – Widespread and frequent in woodlands.
- E. quercinaria* (Hufn.) August Thorn. – Widespread; mainly woodlands.
- E. alniaria* (L.) Canary-shouldered Thorn. – Regular in woodlands; occasional elsewhere.
- E. fuscantiaria* (Haw.) Dusky Thorn. – Frequent in woodlands; occasional elsewhere; formerly frequent in trap 1.
- E. erosaria* ([D.&S.]) September Thorn. – Regular in woodlands; occasional elsewhere.
- Selenia dentaria* (Fabr.) Early Thorn. – Widespread and common, particularly at woodland and hedgerow sites.
- S. lunularia* (Hb.) Lunar Thorn. – Scattered individuals; possibly in decline.
- S. tetralunaria* (Hufn.) Purple Thorn. – Common at woodland sites; occasional elsewhere.
- Odontopera bidentata* (Cl.) Scalloped Hazel. – Common in woodlands; regular elsewhere.
- Crocallys elinguaris* (L.) Scalloped Oak. – Common in woodlands; regular elsewhere.
- Ourapteryx sambucaria* (L.) Swallow-tailed Moth. – Common in woodlands; regular elsewhere.
- Colotois pennaria* (L.) Feathered Thorn. – Common in woodlands; occasional elsewhere.
- Apocheima hispidaria* ([D.&S.]) Small Brindled Beauty. – Evidently frequent to 1950. Subsequent individuals in 1991 at traps 39, 48 and 51 and in 1996 in site 48.
- A. pilosaria* ([D.&S.]) Pale Brindled Beauty. – Common in woodlands; occasional elsewhere.
- Lycia hirtaria* (Cl.) Brindled Beauty. – Frequent in woodlands; occasional elsewhere.
- Biston strataria* (Hufn.) Oak Beauty. – Regular in woodlands; occasional elsewhere.

- B. betularia* (L.) Peppered Moth. – Regular in woodlands; occasional elsewhere; apparent decline in trap 1 but increasing in Geescroft. Both melanic and typical forms are present, the latter being the more common. No discernable change in proportions is evident.
- Agriopsis leucophaearia* (D.&S.) Spring Usher. – Occasional at woodland sites; formerly recorded in trap 1.
- A. aurantiaria* (Hb.) Scarce Umber. – Widespread; common in woodlands.
- A. marginaria* (Fabr.) Dotted Border. – Widespread; common in woodlands.
- Erannis defoliaria* (Cl.) Mottled Umber. – Widespread; common in woodlands.
- Menophora abruptaria* (Thunb.) Waved Umber. – Regular in woodlands; occasional elsewhere.
- Peribatodes rhomboidaria* (D.&S.) Willow Beauty. – Widespread; common in woodlands.
- Deileptenia ribeata* (Cl.) Satin Beauty. – Fifteen records between 1985 and 1992.
- Alcis repandata* (L.) Mottled Beauty. – Common in woodlands; occasional elsewhere.
- Hypomecis roboraria* (D.&S.) Great Oak Beauty. – Trap 8, two in 1948; traps 14 and 15, one each in 1951.
- H. punctinalis* (Scop.) Pale Oak Beauty. – Occasional in Geescroft and Knott Wood.
- Ectropis bistortata* (Goeze) The Engrailed and *E. crepuscularia* (D.&S.) Small Engrailed. – Not routinely separated but both species occur at woodland sites, sometimes commonly. A third generation of the normally bivoltine *E. bistorta* is sometimes recorded. (Riley & Townsend, 1991d; 1992a).
- Parectropis similaria* (Hufn.) Brindled White-spot. – Occasional at woodland sites.
- Aethalura punctulata* (D.&S.) Grey Birch. – Occasional at woodland sites.
- Bupalus piniaria* (L.) Bordered White. – Trap 15, one in 1951; trap 65, one in 1964; trap 37, one in 1991. (Riley & Townsend, 1992c).
- Cabera pusaria* (L.) Common White Wave. – Regular in woodlands; occasional elsewhere.
- C. exanthemata* (Scop.) Common Wave. – Regular in woodlands; occasional elsewhere.
- Lomographa bimaculata* (Fabr.) White Pinion-spotted. – Frequent in woodlands; occasional elsewhere.
- L. temerata* (D.&S.) Clouded Silver. – Frequent at woodland and hedgerow sites; occasional elsewhere.
- Theria primaria* (Haw.) Early Moth. – Regular in woodlands; formerly frequent in trap 1.
- Campaea margaritata* (L.) Light Emerald. – Common in woodlands; occasional elsewhere.
- Hylaea fasciaria* (L.) Barred Red. – Occasional in Geescroft and Manor Wood; scattered individuals elsewhere, including Tower Suction-trap 30.

#### SPHINGIDAE

- Sphinx ligustri* (L.) Privet Hawk-moth. – Twenty individuals in four traps, 1946 to 1949. Not recorded since.
- Hyloicus pinastri* (L.) Pine Hawk-moth. – Trap 14, one in 1951; trap 35, one in 1990 (both M.V.) (Riley & Townsend, 1991a); trap 57, one in 1996.
- Mimas tiliae* (L.) Lime Hawk-moth. – Regular in trap 35; occasional in Geescroft; irregular scattered individuals elsewhere.
- Smerinthus ocellata* (L.) Eyed Hawk-moth. – Regular in traps 1, 6, 7 & 8 from 1933 to 1949; subsequently only in trap 35, one in 1996.
- Laothoe populi* (L.) Poplar Hawk-moth. – Regular widespread individuals.
- Macroglossum stellatarum* (L.) Hummingbird Hawk-moth. – One full-grown larva near Barnfield, 1992.
- Deilephila elpenor* (L.) Elephant Hawk-moth. – Trap 14, six in 1951; regular in MV traps.

## NOTODONTIDAE

- Phalera bucephala* (L.) Buff-tip. – Occasional widespread individuals.
- Cerura vinula* (L.) Puss Moth. – Seven individuals in traps 6, 7 and 14 between 1946 and 1951. Not recorded since.
- Furcula furcula* (Cl.) Sallow Kitten. – Trap 1, individuals in 1948 and 1983; trap 6, one in 1947.
- Furcula bifida* (Brahm) Poplar Kitten. – Trap 1, two in 1935 and one in 1936; trap 6, one in 1946 and one in 1948.
- Stauropus fagi* (L.) Lobster Moth. – Five in traps 6 and 7, 1946 to 1949; one at site 9 in 1949.
- Notodonta dromedarius* (L.) Iron Prominent. – Occasional in Geescroft. More frequent in 1930s and 1940s.
- N. ziczac* (L.) Pebble Prominent. – Occasional at woodland sites. More frequent prior to 1950.
- Pheosia gnoma* (Fabr.) Lesser Swallow Prominent. – Occasional at woodlands; scattered individuals elsewhere.
- P. tremula* (Cl.) Swallow Prominent. – Occasional in woodlands; frequent in traps 1, 6, 7 & 8 prior to 1960.
- Ptilodon capucina* (L.) Coxcomb Prominent. – Frequent at woodland and hedgerow sites; occasional elsewhere.
- P. cucullina* (D.&S.) Maple Prominent. – Regular in woodlands since 1979.
- Odontotia carmelita* (Esp.) Scarce Prominent. – Trap 50, two in 1992 (Riley & Townsend, 1992a); trap 54, one in 1991.
- Pterostoma palpina* (Cl.) Pale Prominent. – Regular at woodland and hedgerow sites.
- Drymonia dodonaea* (D.&S.) Marbled Brown. – Trap 1, four in 1935; trap 26, one in 1973.
- D. ruficornis* (Hufn.) Lunar Marbled Brown. – Occasional at woodland sites.
- Clostera curtula* (L.) Small Chocolate-tip. – Frequent to 1951. Not recorded since.
- Diloba caeruleocephala* (L.) Figure of Eight. – Infrequent, mainly in woodlands.

## LYMANTRIIDAE

- Orgyia antiqua* (L.) The Vapourer. – Scattered individuals; mainly Geescroft.
- Calliteara pudibunda* (L.) Pale Tussock. – Regular at woodland and hedgerow sites.
- Euproctis chrysorrhoea* (L.) Brown-tail. – Individuals at four sites in 1992 (Townsend, 1993b; Townsend, 1993c).
- E. similis* (Fuessl.) Yellow-tail. – Widespread and common at woodland and hedgerow sites.
- Leucoma salicis* (L.) White Satin Moth. – Eight records prior to 1948; one in 1977 and one in 1992.
- Lymantria monacha* (L.) Black Arches. – Trap 1, one in 1947; site 9, two in 1949; trap 26, one in 1989.

## ARCTIIDAE

- Thumatha senex* (Hb.) Round-winged Muslin. – Occasional scattered individuals.
- Eilema sororcula* (Hufn.) Orange Footman. – Two unconfirmed and doubtful individuals at traps 14 and 15 in 1951 (Hosni, 1953).
- E. griseola* (Hb.) Dingy Footman. – Occasional individuals.
- E. pygmaeola* (Doubl.) Pygmy Footman. – One doubtful and unconfirmed record from trap 1 on 21.vii.1935 (Foster, 1937).
- E. complana* (L.) Scarce Footman. – Widespread but infrequent.
- E. depressa* (Esp.) Buff Footman. – One in trap 52 on 29.vii.1990 (Riley & Townsend, 1991a).
- E. lurideola* (Zinck.) Common Footman. – Widespread and frequent. Common at woodland sites.

- Arctia caja* (L.) Garden Tiger. – Formerly common in trap 1; subsequently recorded occasionally at most sites.  
*Spilosoma lubricipeda* (L.) White Ermine. – Widespread and frequent.  
*S. luteum* (Hufn.) Buff Ermine. – Widespread and frequent.  
*Diaphora mendica* (Cl.) Muslin Moth. – Widespread and regular.  
*Phragmatobia fuliginosa* (L.) Ruby Tiger. – Widespread and regular.  
*Tyria jacobaeae* (L.) The Cinnabar. – Occasional and widespread; formerly frequent in trap 1.

#### NOLIDAE

- Nola cucullatella* (L.) Short-cloaked Moth. – Frequent, mainly at the woodland sites.  
*N. confusalis* (H.-S.) Least Black Arches. – Regular at woodland and hedgerow sites since 1987.

#### NOCTUIDAE

- Euxoa tritici* (L.) White-line Dart. – Trap 6, one in 1947 and three in 1948.  
*E. nigricans* (L.) Garden Dart. – Occasional individuals at many sites, including the suction-traps.  
*Agrotis cinerea* ([D.&S.]) Light Feathered Rustic. – Trap 1, one in 1933; trap 6, one in 1950; trap 26, one in 1982.  
*A. segetum* ([D.&S.]) Turnip Moth. – Widespread and regular.  
*A. clavis* (Hufn.) Heart & Club. – Trap 6, individuals in 1948 and 1949; trap 1, occasional to 1981.  
*A. exclamatoris* (L.) Heart & Dart. – Widespread and common.  
*A. ipsilon* (Hufn.) Dark Sword-grass. – Occasional throughout.  
*A. puta* (Hb.) Shuttle-shaped Dart. – Widespread and regular.  
*Axylia putris* (L.) The Flame. – Widespread and regular.  
*Ochropleura plecta* (L.) Flame-shoulder. – Widespread and frequent.  
*Rhyacia simulans* (Hufn.) Dotted Rustic. – Occasional scattered individuals, 1973 to date; regular in the suction-traps.  
*Noctua pronuba* (L.) Large Yellow Underwing. – Widespread and common; sometimes abundant.  
*N. comes* (Hb.) Lesser Yellow Underwing. – Frequent throughout; often common at woodland sites.  
*N. orbona* (Hufn.) Lunar Yellow Underwing. – Four unconfirmed and very doubtful records in traps 63 and 65 in 1964.  
*N. fimbriata* (Schred.) Broad-bordered Yellow Underwing. – Regular in woodlands; occasional elsewhere.  
*N. janthe* Borkh. Lesser Broad-bordered Yellow Underwing. – Frequent in woodlands; occasional elsewhere.  
*N. interjecta* (Hb.) Least Yellow Underwing. – Occasional; mainly in woodlands.  
*Spaelotis ravida* ([D.&S.]) Stout Dart. – Occasional individuals; more regular in suction-traps.  
*Graphiphora augur* (Fabr.) Double Dart. – Frequent throughout, though apparently decreasing.  
*Lycophotia porphyrea* ([D.&S.]) True Lover's Knot. – Seven in trap 1 in 1948. Only two records since.  
*Peridroma saucia* (H.b) Pearly Underwing. – Nine records between 1949 and 1990.  
*Diarsia mendica* (Fabr.) Ingrailed Clay. – Frequent throughout; common in woodlands.  
*D. brunnea* ([D.&S.]) Purple Clay. – Common at woodland sites; infrequent elsewhere.  
*D. rubi* (View.) Small Square-spot. – Common throughout.  
*Xestia c-nigrum* (L.) Setaceous Hebrew Character. – Common throughout.



- X. ditrapezium* ([D.& S.]) Triple-spotted clay. – Twenty unconfirmed records in 1964. Almost certainly erroneous.
- X. triangulum* (Hufn.) Double Square-spot. – Common at woodland sites; less frequent elsewhere.
- X. baja* ([D.&S.]) Dotted Clay. – Regular at woodland sites, though never common.
- X. rhomboidea* (Esp.) Square-spotted Clay. – Four unconfirmed records in 1949. Almost certainly erroneous.
- X. sexstrigata* (Haw.) Six-striped Rustic. – Frequent throughout, especially woodlands.
- X. xanthographa* ([D.&S.]) Square-spot Rustic. – Common throughout.
- Naenia typica* (L.) The Gothic. – Scattered individuals most years.
- Eurois occulta* (L.) Great Brocade. – Trap 26, one in 1977 one in 1983 and two in 1996; trap 33, one in 1977.
- Anaplectoides prasina* ([D.&S.]) Green Arches. – Site 9, one in 1949; trap 33, one in 1974.
- Cerastis rubricosa* ([D.&S.]) Red Chestnut. – Regular, particularly in woodlands.
- Discestra trifolii* (Hufn.) The Nutmeg. – Regular throughout; infrequent in woodlands.
- Hada plebeja* (L.) The Shears. – Formerly frequent in trap 1; presently uncommon.
- Polia bombycina* (Hufn.) Pale Shining Brown. – Frequent to 1949; not recorded since 1986.
- P. nebulosa* (Hufn.) Grey Arches. – A few records, mainly from woodland sites, to 1981.
- Heliophobus reticulata* (Goeze) Bordered Gothic. – Frequent to 1948; not recorded since.
- Mamestra brassicae* (L.) Cabbage Moth. – Regular throughout.
- Melanchna persicariae* (L.) Dot Moth. – Regular throughout.
- Lacanobia w-latinum* (Hufn.) Light Brocade. – Regular in 1940s and 1950s; not recorded since 1960.
- L. thalassina* (Hufn.) Pale-shouldered Brocade. – Regular throughout.
- L. oleracea* (L.) Bright-line Brown-eye. – Common throughout.
- Ceramica pisi* (L.) Broom Moth. – Frequent in 1940s; scattered individuals since.
- Hecatera bicolorata* (Hufn.) Broad-barred White. – Regular and widespread.
- Hadena rivularis* (Fabr.) The Champion. – Widespread but infrequent.
- H. perplexa* ([D.&S.]) Tawny Shears. – Regular to 1949; infrequent since; last recorded in 1980.
- H. compta* ([D.&S.]) Varied Coronet. – Six records since 1972.
- H. confusa* (Hufn.) Marbled Coronet. – Scattered individuals to 1984.
- H. bicurvis* (Hufn.) The Lychnis. – Regular individuals in Geescroft.
- Cerapteryx graminis* (L.) Antler Moth. – Regular to 1949; infrequent since.
- Tholera cespitis* ([D.&S.]) Hedge Rustic. – Frequent in 1940s; a few individuals recorded to 1976.
- T. decimalis* (Poda) Feathered Gothic. – Common in trap 1 in the 1930s and 1940s; infrequent since.
- Panolis flammea* ([D.&S.]) Pine Beauty. – Trap 6, one in 1948; trap 52, one in 1990 (Townsend & Riley, 1991a).
- Orthosia cruda* ([D.&S.]) Small Quaker. – Common and possibly increasing in woodlands.
- O. populeti* (Fabr.) Lead-coloured Drab. – Occasional individuals.
- O. gracilis* ([D.&S.]) Powdered Quaker. – Frequent in woodlands; formerly frequent at Barnfield.
- O. cerasi* (Fabr.) Common Quaker. – Common, especially in woodlands.
- O. incerta* (Hufn.) Clouded Drab. – Common, especially in woodlands.
- O. munda* ([D.&S.]) Twin-spotted Quaker. – Regular, mainly in woodlands.
- O. gothica* (L.) Hebrew Character. – Common, especially in woodlands.

- Mythimna conigera* ([D.&S.]) Brown-line Bright-eye. – Infrequent in woodlands; often common elsewhere.
- M. ferrago* (Fabr.) The Clay. – Common throughout.
- M. viellina* (Hb.) The Delicate. – Trap 35, one on 26/27.viii.1992.
- M. impura* (Hb.) Smoky Wainscot. – Numbers fluctuate but usually very common throughout.
- M. pallens* (L.) Common Wainscot. – Numbers fluctuate but usually very common throughout.
- M. comma* (L.) Shoulder-striped Wainscot. – Frequent throughout.
- Cucullia chamomillae* ([D.&S.]) Chamomile Shark. – Traps 6 and 7, individuals in 1946; trap 27, one in 1976.
- C. umbratica* (L.) The Shark. – Widespread individual records.
- Shargacucullia verbasci* (L.) The Mullein. – Trap 1, one in 1935; trap 56, one in 1992.
- Brachyolmia viminalis* (Fabr.) Minor Shoulder-knot. – Frequent to 1961; not recorded since.
- Brachionycha sphinx* (Hufn.) The Sprawler. – Common in woodlands; formerly frequent in trap 1.
- Aporophila lutulenta* ([D.&S.]) Deep-brown Dart. – Widespread but infrequent.
- A. nigra* (Haw.) Black Rustic. – Scarce, mainly Geescroft.
- Lithophane semibrunnea* (Haw.) Tawny Pinion. – Apart from one in 1947, occasional individuals since 1972. Most frequent in suction-traps.
- L. hepatica* (Hufn.) Pale Pinion. – Trap 30, one in 1989.
- L. ornitopus* (Hufn.) Grey shoulder-knot. – Regular in woodlands; otherwise infrequent. Only two records prior to 1982.
- L. leautieri* (Boisd.) Blair's Shoulder-knot. – Regular in most traps. First recorded in 1990.
- Xylene exsoleta* (L.) Sword-grass. – Trap 1, one in 1946.
- Xylocampa areola* (Esp.) Early Grey. – Infrequent; mainly in woodlands.
- Allophyes oxyacanthae* (L.) Green-brindled Crescent. – Common in woodlands.
- Dichonia aprilina* (L.) Merveille du jour. – Occasional in woodlands.
- Drybotodes eremita* (Fabr.) Brindled Green. – Regular in woodlands.
- Mniotype adusta* (Esp.) Dark Brocade. – Frequent in traps 1 and 6 in the 1930s and 1940s. No recent records.
- Polymixis flavicincta* ([D. & S.]) Large Ranunculus. – Several in traps 1 and 6 in the 1930s and 1940s; traps 26 and 33, individuals in 1983, 1984 and 1989.
- Eupsilia transversa* (Hufn.) The Satellite. – Common in woodlands; infrequent elsewhere.
- Conistra vaccinii* (L.) The Chestnut. – Common in woodlands; infrequent elsewhere.
- C. ligula* (Esp.) Dark Chestnut. – Frequent in woodlands; uncommon elsewhere.
- Agrochola circellaris* (Hufn.) The Brick. – Common, mainly in woodlands.
- A. lota* (Cl.) Red-line Quaker. – Regular, mainly in woodlands.
- A. macilenta* (Hb.) Yellow-line Quaker. – Common, mainly in woodlands.
- A. helvola* (L.) Flounced Chestnut. – Occasional in Geescroft; formerly more widespread but always scarce.
- A. litura* (L.) Brown-spot Pinion. – Common, especially in woodlands.
- A. lychnidis* ([D.&S.]) Beaded Chestnut. – Common, mainly in woodlands.
- Atethmia centrago* (Haw.) Centre-barred Sallow. – Widespread and regular in woodlands.
- Omphaloscelis lunosa* (Haw.) Lunar Underwing. – Common, mainly in woodlands.
- Xanthia citrago* (L.) Orange Sallow. – Regular, mainly in woodlands.
- X. aurago* ([D.&S.]) Barred Sallow. – Regular, mainly in woodlands.
- X. togata* (Esp.) Pink-barred Sallow. – Widespread but infrequent; usually woodlands.
- X. ictertia* (Hufn.) The Sallow. – Regular, mainly in woodlands.
- X. gilvago* ([D.&S.]) Dusky-lemon Sallow. – Formerly frequent in Geescroft; last recorded in 1978.

- Acrionicta megacephala* (D.&S.) Poplar Grey. – Infrequent, scattered individuals.
- A. aceris* (L.) The Sycamore. – Scarce; six records only.
- A. leporina* (L.) The Miller. – Infrequent individuals, mainly Geescroft.
- A. alni* (L.) Alder Moth. – Trap 26, one on 25.vi.1985.
- A. tridens* (D.&S.) Dark Dagger. – Infrequent individuals.
- A. psi* (L.) Grey Dagger. – Occasional scattered records.
- A. rumicis* (L.) Knot Grass. – Infrequent but widespread.
- Cryphia domestica* (Hufn.) Marbled Beauty. – Regular and widespread but in small numbers.
- Amphipyra pyramidea* (L.) Copper Underwing. – Regular in woodlands.
- A. berbera* (Rungs) Svensson's Copper Underwing. – Frequent in woodlands; irregular elsewhere.
- A. tragopoginis* (Cl.) Mouse Moth. – Most frequent in suction-traps; regular and widespread.
- Mormo maura* (L.) Old Lady. – Infrequent; mainly in Geescroft.
- Dypterygia scabriuscula* (L.) Bird's Wing. – Scattered widespread individuals.
- Rusina ferruginea* (Esp.) Brown Rustic. – Common, especially in woodlands.
- Thalpophila matura* (Hufn.) Straw Underwing. – Frequent throughout, though less so in woodlands.
- Euplexia lucipara* (L.) Small Angle Shades. – Common, mainly in woodlands.
- Phlogophora meticulosa* (L.) Angle Shades. – Frequent, especially in woodlands.
- Ipimorpha retusa* (L.) Double Kidney. – Trap 8, one in 1948; trap 26, one in 1983.
- I. subtusa* (D.&S.) The Olive. – Regular in small numbers in Geescroft. Infrequent elsewhere.
- Parastichtis suspecta* (Hb.) The Suspected. – Trap 36, one on 20/21.vii.1989.
- P. ypsilon* (D.&S.) Dingy Shears. – Occasional widespread individuals.
- Dicycla oo* (L.) Heart Moth. – Eleven records, 1933-1952. Not seen since.
- Cosmia affinis* (L.) Lesser-spotted Pinion. – Regular in woodlands.
- C. diffinis* (L.) White-spotted Pinion. – Regular prior to 1952; three records since; last 1976.
- C. trapezina* (L.) The Dun-bar. – Common, particularly in woodlands.
- C. pyralina* (D.&S.) Lunar-spotted Pinion. – Regular, mainly in woodlands.
- Apamea monoglypha* (Hufn.) Dark Arches. – Common throughout; abundant some years.
- A. lithoxylaea* (D.&S.) Light Arches. – Frequent, particularly in woodlands.
- A. sublustris* (Esp.) Reddish Light Arches. – Trap 26, one on 23.vii.1996.
- A. crenata* (Hufn.) Clouded-bordered Brindle. – Regular, mainly in woodlands.
- A. epomidion* (Haw.) Clouded Brindle. – Regular, mainly in woodlands.
- A. remissa* (Hb.) Dusky Brocade. – Regular, mainly in woodlands.
- A. unanimitis* (Hb.) Small Clouded Brindle. – Widespread but infrequent.
- A. anceps* (D.&S.) Large Nutmeg. – Frequent throughout.
- A. sordens* (Hufn.) Rustic Shoulder-knot. – Frequent throughout.
- A. scolopacina* (Esp.) Slender Brindle. – Occasional individuals.
- A. ophiogramma* (Esp.) Double Lobed. – Occasional individuals.
- Oligia strigilis* (L.) Marbled Minor. – Common throughout.
- O. versicolor* (Borkh.) Rufous Minor. – Recorded occasionally between 1974 and 1993.
- O. latruncula* (D.&S.) Tawny Marbled Minor. – Common throughout.
- O. fasciuncula* (Haw.) Middle-barred Minor. – Common throughout.
- Mesoligia furuncula* (D.&S.) Cloaked Minor. – Frequent; most common at grassland sites.
- M. literosa* (Haw.) Rosy Minor. – More common in the 1940s; infrequent recently.
- Mesapamea secalis* (L.) Common Rustic. – Common throughout.
- M. didyma* (Esp.) Lesser Common Rustic. – Common throughout.
- Photodes minima* (Haw.) Small Dotted Buff. – Regular throughout.
- Chortodes pygmina* (Haw.) Small Wainscot. – One unconfirmed record from trap 1 on 24.ix.1946. The few subsequent records proved to be erroneous.

- Eremobia ochroleuca* ([D.&S.]) Dusky Sallow. – Scattered individuals; more frequent prior to 1980s.
- Luperina testacea* ([D.&S.]) Flounced Rustic. – Common, especially at grassland sites.
- Amphipoea lucens* (Freyer) Large Ear. – Trap 42, one on 23/24.viii.1990 (Riley & Townsend, 1991b).
- A. fucosa* (Freyer) Saltern Ear. – Trap 6, one on 25/26.viii.1949 (Riley & Townsend, 1991b).
- A. oculea* (L.) Ear Moth. – Common in trap 49; less so elsewhere.
- Hydraecia micacea* (Esp.) Rosy Rustic. – Frequent throughout.
- Gortyna flavago* ([D.&S.]) Frosted Orange. – Infrequent but widespread.
- Celaena leucostigma* (Hb.) The Crescent. – Trap 37, one on 23/24.vii.1992 (Townsend, 1993a).
- Nonagra typhae* (Thunb.) Bulrush Wainscot. – Trap 54, one on 19/20.viii.1991 (Townsend & Riley, 1992a).
- Rhizedra lutosa* (Hb.) Large Wainscot. – Individuals in trap 6 in 1946 and 1947, trap 33 in 1979 and 1987 and trap 58 in 1996.
- Charanyca trigrammica* (Hufn.) Treble Lines. – Widespread and regular.
- Hoplotriona alsines* (Brahm) The Uncertain. – Common, particularly in woodlands.
- H. blanda* ([D.&S.]) The Rustic. – Widespread and regular.
- H. ambigua* ([D.&S.]) Vine's Rustic. – Widespread but infrequent.
- Spodoptera exigua* (Hb.) Small Mottled Willow. – Trap 7, one 1947; trap 6, five in 1947; trap 1, two in 1949 and three in 1966.
- Caradrina morpheus* (Hufn.) Mottled Rustic. – Common throughout.
- Paradrina clavipalpis* (Scop.) Pale Mottled Willow. – A few scattered individuals.
- Chilodes maritimus* (Tausch.) Silky Wainscot. – Trap 5, one on 24.vi.1935 (Williams, 1939); trap 38, one on 10.viii.1991 (Townsend & Riley, 1992a).
- Pyrhnia umbra* (Hufn.) Bordered Sallow. – Trap 6, individuals in 1946 and 1947; trap 8, one in 1948; trap 27, one in 1971.
- Heliothis virespila* (Hufn.) Marbled Clover. – Trap 6, one in 1946; trap 7, one in 1947.
- H. peltigera* ([D.&S.]) Bordered Straw. – Trap 15, one in 1951.
- Protodeltote pygarga* (Hufn.) Marbled White Spot. – Trap 26, one in 1975; trap 33, one in 1989.
- Deltote uncula* (Cl.) Silver Hook. – Trap 6, one in 1947; trap 1, three in 1947, one in 1948 and one in 1970.
- Bena bicolorana* (Fuessly) Scarce Silver-lines. – Seven records between 1947 and 1978.
- Pseudoips prasinana* (L.) ssp. *britannica* Warren Green Silver-lines. – Regular in woodlands.
- Nycteoia revayana* (Scop.) Oak Nycteoine. – Regular, mainly in woodlands.
- Colocasia coryli* (L.) Nut-tree Tussock. – Widespread but infrequent.
- Raphia frater* Grote The Brother. – Trap 6, one on 3.viii.1949. Only record for the British Isles.
- Diachrysia chrysitis* (L.) Burnished Brass. – Fairly common, especially in woodlands.
- Polychrysia moneta* (Fabr.) Golden Plusia. – Infrequent, mainly Geescroft.
- Plusia festucae* (L.) Gold Spot. – Trap 1, one in 1947; trap 6, one in 1947.
- Autographa gamma* (L.) Silver Y. – Common throughout.
- A. pulchrina* (Haw.) Beautiful Golden Y. – Regular, mainly in woodlands.
- A. jota* (L.) Plain Golden Y. – Regular, mainly in woodlands.
- Abrostola triparita* (Hufn.) The Spectacle. – Frequent, mainly in woodlands.
- Catocala nupta* (L.) Red Underwing. – Infrequent, mainly woodlands.
- Tyta luctuosa* ([D.&S.]) The Four-spotted. – Frequent in trap 1, 1933 to 1948; six records from traps 6, 8 and 14 between 1946 and 1952.

- Lygephila pastinum* (Treit.) The Blackneck. – Trap 14, one in 1951; trap 26, one in 1976.  
*Scoliopteryx libatrix* (L.) The Herald. – Regular in Geescroft; occasional elsewhere.  
*Laspeyria flexula* ([D.&S.]) Beautiful Hook-tip. – Regular, especially woodlands.  
*Rivula sericealis* (Scop.) Straw Dot. – Regular and widespread. Most frequent in woodlands.  
*Parascotia fuliginaria* (L.) Waved Black. – Four records from Geescroft, 1966 to 1986.  
*Hypena crassalis* (Fabr.) Beautiful Snout. – Trap 26, one in 1985.  
*H. proboscidalis* (L.) The Snout. – Common, especially in woodlands.  
*Zanclognatha tarsipennalis* (Treit.) The Fan-foot. – Common, especially in woodlands.  
*Hermia grisealis* ([D.&S.]) Small Fan-foot. – Common, especially in woodlands.

### Discussion

This list is a result of 63 years of almost continuous sampling of Lepidoptera on the Rothamsted Estate. It catalogues probably the most intensive sampling of this Order ever undertaken in any part of the British Isles, if not the world. A total of 656,444 individuals from RIS traps are recorded on the Insect Survey database and many more from different designs of trap have been examined.

The total of 452 species compares favourably with many county lists. As such, it is probably as comprehensive as one could hope to compile for any discrete area. Previously unrecorded species are now added only very rarely and it is probably safe to assume that virtually all the resident species are represented here. Perhaps more importantly, those species that formerly occurred on the Estate, but no longer do so, are also documented. The reasons for their decline and probable extinction can now be discussed – an important consideration when dealing with the conservation of semi-natural habitats in an agricultural landscape.

Since the 1940s, agricultural intensification on the Estate has been significant. It is therefore perhaps surprising that, in the first half of the trapping period (1933 to 1964), there were fewer (27) species recorded exclusively during that time than during the years 1965 to 1996 (33 species). However, this is almost certainly the result of more intensive and widespread sampling in recent years rather than any improvements in the general habitat. Of those species not recorded since 1964, some speculative explanations can be made.

Several of the species that have not been recorded recently are associated with specific trees. For example, *C. vinula*, *F. bifida* and *C. curtula* on *Populus* and/or *Salix* and *C. diluta* and *H. roboraria* on *Quercus*. The reduction or removal of these trees almost certainly accounts for the loss of the moths. In a more general sense, the removal of hedgerows containing *Crataegus* and *Prunus*, and the removal of an orchard from near Barnfield has probably contributed to the loss or rarity of *M. neustria* and *G. quercifolia*. Nine species (*S. bipunctaria*, *C. rubidata*, *C. olivata*, *C. multistrigaria*, *H. reticulata*, *L. w-latinum*, *B. viminalis*, *M. adusta* and *T. luctuosa*) associated more or less specifically with calcareous grassland, downland and scrub disappeared during the 1940s and 1950s. Prior to this, Harpenden Common extended into the Estate, providing the required habitat for these species. The subsequent expansion of intensive arable agricultural development has almost certainly accounted for their loss. Several other species associated with downland or

permanent grassland have also declined but are still recorded in small numbers. They probably remain present on Harpenden Common and occasionally wander, or are blown, onto the Estate. In all, 31 species appear to show a significant decline in numbers over the sampling period whereas only six (*I. trigeminata*, *E. dodoneata*, *T. juniperata*, *O. cruda*, *L. ornitopus* and *L. leautieri*) have invaded or increased. These observations are related to a general decline in the presence and quality of semi-natural habitats in this area. Four other species (*S. ligustri*, *D. oo*, *C. diffinis* and *X. exsoleta*) were lost during the 1940s but each apparently has undergone a national decline. A more detailed statistical analysis of these trends is in preparation.

Recognition of the importance of semi-natural habitats for maintaining biodiversity and protecting sensitive species and assemblages on agricultural land has increased in recent years. Further, establishment of set-aside and other changes in farming practices, as well as predicted climate change, will undoubtedly affect Lepidoptera and other groups. In order to assess the biological and ecological effects of these changes, long-term monitoring projects, such as the RIS, will continue to provide vital information.

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### Two new and surprising records of the ant lion *Euroleon nostras* (Geoffroy in Fourcroy) (Neur.: Myrmeleontidae) in southern England

On the morning of 2 September 1998, Gill Hollamby and DW were surprised to discover an adult ant lion *Euroleon nostras* near to the m.v. light trap in the garden of Dungeness Bird Observatory, East Kent. The specimen was photographed before release and the identification was confirmed, from the resultant images, by CWP. Four days later, CWP received a telephone call from Colin Milkins of St Leonard's-on-Sea, East Sussex, to say that he had encountered an adult of the same species in a spider web in his garden on 6 September 1998. This record was particularly interesting since, apart from it being of a second specimen in the same general area of southern English coast in four days, Mr Milkins was of the opinion that its wing was deformed – something which would suggest that it would be unable to fly and was probably a locally bred insect. This specimen was subsequently seen by CWP; both the identification and the teneral nature of the insect were confirmed. The specimen is deposited in CWP's collection.

*Euroleon nostras* was not formally added to the British fauna until 1996 when it was discovered at the RSPB reserve at Minsmere, East Suffolk (Mendel, *Ent. Rec.* **108**: 1-5). Since then, it has been the subject of an intensive study by CWP, funded by English Nature, RSPB and CWP. This work (Plant, 1997. *Investigations into the distribution, status and ecology of the ant-lion Euroleon nostras* (Geoffroy in Fourcroy, 1785) (Neuroptera: Myrmeleontidae) in England during 1997 – unpublished full report in